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FutureReady

WHERE THE SMART GRID IS HEADING

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THE NEXT STEP

Smart grid technology — from advanced metering to grid management — is being adopted at rapid rates. So the question many industry observers are asking is, "What's the next step?"

The answer certainly varies for each utility. But for the industry as a whole, continuing work on development and adoption of standards will guide many of the future possibilities for the investments utilities are making today.

In this issue of *FutureReady*, we take a look at how standards design and development have already played a role in software integration and data management applications. We also take an in-depth look at how standards for communication technologies are evolving and what that means for not only interoperability of systems and applications, but also the prospect of hardware interchangeability.

Certainly standards also impact more than just systems and technology. The smart grid is enabling new ways to manage load and bring distributed energy resources online, all while monitoring transactions in near real time. Developing a framework for this new world of Transactive Energy will lead to a standardized approach to managing new types of energy transactions.

Many of these changes and new opportunities mean an increasing role for consumers. The Smart Grid Consumer Collaborative (SGCC) is actively involved in helping consumers understand what this new technology will mean for them. Our interview with Patty Durand, SGCC's Executive Director, explores some of the challenges facing consumer engagement efforts.

At Landis+Gyr, we can't promise to predict the future. But our leadership role in the standards process means we will help our customers prepare for it. That's what being *Future Ready* is all about.

Richard Mora
Landis+Gyr President & CEO Americas

TURNING obsolescence INTO Opportunity:

Making the Business Case for Upgrades

As today's electric utilities integrate digital, smart grid components into their infrastructures, they are quickly facing a sobering reality: Many existing assets may become obsolete well before they are fully depreciated.

For example, many utilities had calculated the depreciation of their traditional electromechanical meters as having a useful lifespan of 30 to 40 years. With the advent of advanced metering and smart grid technology, utilities are now faced with planning life cycles for a new and interrelated set of assets.

Moving forward, it will be important for utility managers to take a proactive approach to managing the risk of obsolescence of these complex technologies. "Obsolescence

management should be considered during system design and when planning for life cycle sustainment," says Dr. Peter Sandborn, Department of Mechanical Engineering, University of Maryland. A noted expert on obsolescence management, Sandborn notes that even the most proactive approaches can be derailed by unanticipated life extensions. "Product or system replacement dates are often moving targets, because of budget constraints and other factors," he adds.

Making the business case for upgrades

When determining a replacement timeline for hardware, utilities can begin to build a business case for a system upgrade.

> "By looking at the books to see what assets are nearly depreciated, utilities can build a cost-benefit analysis and a business case for a system upgrade."
>
> — Steven Schamber, Vice President and General Manager, Landis+Gyr

But thinking only about the smart grid hardware can prove short-sighted, according to Dr. Sandborn. Software obsolescence and upgrades must be factored in, as well.

Of course, all of this planning requires significant cross-departmental collaboration. "It takes a lot of due diligence and cooperation within the utility," Schamber says. "It's important to re-engineer from the inside out."

In addition, utilities will need to help regulators understand that smart grid assets have a shorter depreciation schedule, which will need to be built into the rate. On their end, regulators will be looking at the potential benefits of the upgrade. "They will want to know how the technology will improve reliability of the grid," says Schamber. "They'll also want to look at whether a system upgrade will provide additional benefits — more capacity, reliability and safety — to justify the additional cost of the upgrade."

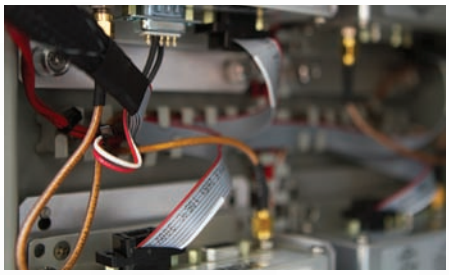
Importance of future readiness

When making investments in smart grid technologies, utilities should always consider only those assets and systems that support future upgrades, to prevent the need for large-scale changes. By employing a strategy of interim migration, the utility is better able to keep pace with new technologies and capabilities. "That's where Landis+Gyr excels," says Schamber. "We have a long history of building for upgradeability and offering ongoing support for legacy systems." ■

FROM Interoperable TO Interchangeable:

The Next Trend in AMI Technology

For many years, utilities have been seeking the ability to upgrade portions of their AMI networks without having to make sweeping network changes. Today, the industry is inching closer to this ideal environment — one in which utilities will be able to mix and match network platforms and endpoints to take advantage of the latest smart grid innovations.



The GridWise® Architecture Council (GWAC), an organization created by the U.S. Department of Energy (DOE), defines smart grid interoperability as "the seamless, end-to-end connectivity of hardware and software from the customers' appliances all the way through the transmission and distribution system to the power source, enhancing the coordination of energy flows with real-time flows of information and analysis."[1]

Ensuring this type of interoperability, particularly for RF mesh systems, is an increasing industry priority. Driven by the need for greater reliability and efficiency, many vendors are shifting focus from proprietary communications technologies toward standards-based solutions — and moving the industry closer to multivendor, interoperable networks.

What utilities want

The hope, as expressed by the DOE, is that new technology-neutral interoperability standards will create an environment in which "new devices will all interoperate in a secure environment" and "enable innovation, improve consumer choice and yield economies of scale."[2] As utilities decide to replace devices, they will be able to do so in a more piecemeal fashion, without the need to replace entire systems. That's the goal.

If interoperability is the goal, interchangeability is the ideal. While interoperability refers to the measure of how well devices can interact, interchangeability is the measure of how easily multiple, functionally equivalent devices can be directly substituted for each other. "Interoperability comes first, and having standards in place to accomplish that is a must," says Ruben Salazar, Director of Research and Technology, Landis+Gyr. "Interchangeability comes later."

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As smart grids mature and the need arises to improve grid operations, it may not be necessary to replace devices at every endpoint on a distribution system. The best solution could be to install newer intelligent devices at locations with the most potential for monitoring and control. According to Randy Edwards, Director of Product Management, Network Communications at Landis+Gyr, "the ability to mix and match smart meters and other devices from multiple vendors is on the wish list of every utility."

Interchangeability — pros and cons

Let's take a look at some of the pros and cons of interchangeability to understand what works best for a utility's unique requirements.

Flexibility is among the many benefits of interchangeability. With the ability to mix and match devices from many sources, utilities will no longer need to be locked into working with one single vendor. They will also benefit from a newly competitive marketplace. When true interchangeability is a reality, vendors will compete on price as utilities look to replace devices, even after they have selected a platform, but considerations such as product features and dependability will remain an important part of the buying process. Without the need to work with a single vendor, utilities will be better able to leverage new technologies as they become available.

Yet, even with the many benefits that interchangeability offers, utilities should think through new challenges of mixing and matching devices. "In that scenario, there may be no single resource for help with troubleshooting," says Salazar. "A single provider can provide a more global or holistic view of the situation."

There are other implications, too. Opting for a network platform or component designed to an interoperability standard must have the future option of interchangeability. However, this could limit higher-end capabilities that go beyond standard specifications.

Interoperability and interchangeability — where do we stand?

With C12.19, the Electric Power Research Institute (EPRI) and American National Standards Institute (ANSI) have pushed for a common structure for representing data. "That was the first move toward interoperability," says Salazar. "What we're working on now is a way to agree on the options in order to achieve interchangeability."

In March 2013, the ZigBee® Alliance announced the release of the new IP Standard. ZigBee IP is a communication solution for the home environment. Building on that expertise, the ZigBee Alliance has launched the development of an IEEE/IPv6-based communication stack for a utility communications network. "Today, a complete technical requirement document is being built among key industry players," says Salazar. "The specification that will follow the process will take about another year."

So, what's the outlook for smart grid system interchangeability? According to Edwards, the industry is several years away from mix-and-match, plug-and-play capabilities.

"Even when standards are ratified at the end of 2014, the industry will need considerable time for implementation. Compatibility and integration testing could take years."

Subtle differences in the ways that vendors choose to implement the standards are likely. Edwards predicts the rollout will happen in a piecemeal fashion — one vendor at a time, one customer at a time. Moving forward, utilities may also seek higher affirmation and assurance of performance from vendors.

Positioned for interchangeability

As the industry transitions to a new way of doing business, Landis+Gyr is actively engaged in the charge for the development and implementation of new interoperability standards that will make interchangeability possible.

Working with other key industry players, we helped shape the IEEE 802.15.4g and 802.15.4e radio standards, an instrumental leap toward establishing common and consistent communication specifications for utilities deploying smart grid technologies. Landis+Gyr was also one of three industry leaders that founded the IDIS (Interoperable Device Interface Specifications) Association, a global organization dedicated to making interoperability a reality in the smart meter industry.

Clearly, the industry is making major strides toward interchangeability, but there is still a great deal of work that needs to be done. As stakeholders continue to support efforts to develop standards-based solutions, technology leaders like Landis+Gyr will be well-positioned to deliver what utilities want — truly interchangeable, mix-and-match platforms and endpoints that will enable them to maximize their smart grid investments. ■

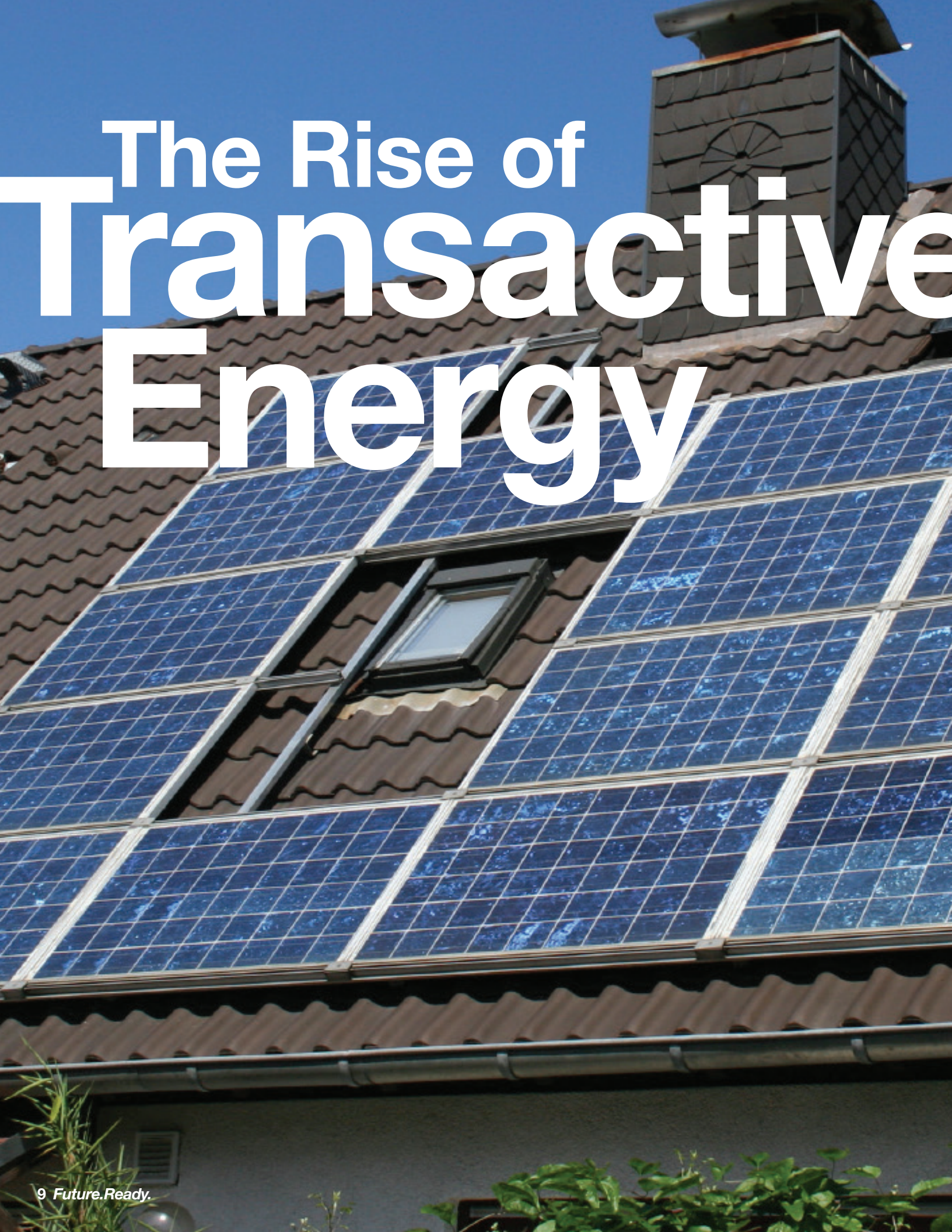
New Questions to Consider

As utilities think ahead to the era of interchangeability, some questions they must be prepared to ask include:

- ***Are your products standards-based?***
- ***How do you handle security?***
- ***What testing have you done with other hardware suppliers?***
- ***What data elements will your technology provide? In what timeframes?***
- ***How is data prioritized during transmission? How will this affect the ability to handle command and control functions?***

1 "Reliability Benefits of Interoperability," p. 1, GridWise® Architecture Council, http://www.gridwiseac.org/pdfs/reliability_interoperability.pdf

2 U.S. DOE: Smart Grid: http://energy.gov/oe/technology-development/smart-grid



The Rise of Transactive Energy

Adopting a Framework for Managing Energy Transactions

Most of the smart grid industry's ongoing standards development work is focused on making technology as interoperable and secure as possible. But the rapid adoption of technology, with all the possibilities it brings for grid efficiency and consumer engagement, is also generating a desire to standardize the process by which energy transactions take place.

With this objective in mind, the GridWise® Architecture Council (GWAC) is developing a framework for discussing Transactive Energy issues between all market participants. After an agreed-upon framework, the next step will adopt common standards to identify, integrate and monetize energy transactions.

The GWAC defines Transactive Energy as a "technique for managing the generation, consumption or flow of electric power…through the use of economic or market-based constructs while considering grid reliability constraints."

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Simply put, Transactive Energy is about identifying and managing all the grid's new transaction points brought about by smart grid technology adoption, changing energy markets and the proliferation of distributed generation.

"The traditional model of central generation delivering power to distribution networks, and then to consumers in a unidirectional way, is changing," said H. Ward Camp, Vice President of Regulatory and Environmental Policy at Landis+Gyr. "Smart grid technology is not only changing what is possible, but also what may be desirable for efficient energy management."

New Capabilities, New Needs

Some new processes that will impact future energy transactions:

- ***The level and variety of demand response transactions are increasing —*** From traditional load control to virtual peaking plants, the reliance on load management programs for reducing peak energy demands is growing.
- ***The growth of distributed energy resources —*** This includes not only renewable generation on the utility side, but also the increasing penetration of microgrids and consumer-side generation and energy storage.
- ***The continuing rise of sensor technologies and the interoperation of devices —*** Smart grid technologies and consumer technologies are integrating, creating new connection points across the grid.

> "There are a lot of moving targets and interested parties in this process. Developing a framework is all about balancing a variety of interests, proceeding together to integrate technologies and ensuring there is a solid procedure for setting value of energy transactions."
>
> — H. Ward Camp, Vice President of Regulatory and Environmental Policy at Landis+Gyr

Organizers are clear to point out that the framework for Transactive Energy is not intended as an architecture or set of standards for best implementation of transactions. Instead, it is a necessary first step to enable future standards development.

A draft GWAC framework was released in early November. After a series of reviews, a second Transactive Energy conference will be held in December 2014. ■

Standards-Based Design For Data Management Applications

Adopting common standards for hardware and software interaction is an important step in any technology field. As smart grid technology continues to evolve, standards are necessary to protect a utility's investment, but also to ensure that investment supports existing utility systems.

A little more than a decade ago, when meter data management (MDM) solutions were first deployed to support widespread adoption of advanced metering, the major business case justifying an MDM solution purchase was meter-to-cash or revenue operations. This meant integrating the MDM system to billing and/or customer information systems to provide validated register readings, billing determinants, time-of-use configurations, and device program IDs. At that time, utilities could afford to use custom integration.

Now, as utilities address an abundance of — and a growing set of — advanced use cases data, it becomes increasingly important to cost-effectively integrate MDM solutions with applications outside of billing and customer information systems. Standards play a large role in enabling this.

"Utilities need to look much more holistically at their smart grid initiatives," said Ruben Salazar, Director of Research and Engineering Administration at Landis+Gyr.

"If those goals include use cases using smart meter data for outage response or load forecasting, the MDM solution needs to support standards-based integration to enable integration with the required solutions."

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The role of standards in leveraging available data

As a core component of utility operations, the MDM solution must easily and quickly integrate with both legacy and future utility systems. Standards-based design reduces integration costs, shortens integration timelines, reduces risks and helps to future-proof the utility's technology investments.

"Without standards, a smart grid solution runs the risk of becoming a stranded asset. This can lead to large and lengthy integration projects, which often delay and reduce the utility's return on investment," Salazar said.

An array of international and industry standards apply to the MDM market segment (see Figure 1). In particular, two standards bodies rise to the top of the list with the most comprehensive guidance for interconnecting MDM solutions with head-end systems and back office solutions — International Electrotechnical Commission (IEC) 61968 series and MultiSpeak® industry standards.

The IEC 61968 series, most often used by larger investor-owned utilities, govern interface architecture and general requirements.

- ***Part 9 of the standard covers meter reading and control***
- ***Part 11 involves extensions for distribution***
- ***Part 100 covers JMS and Web services implementation profiles***

Equally important for the cooperative and public power markets is MultiSpeak and its related standard interfaces for obtaining a meter read, managing a connect/disconnect command, conducting outage analysis and connecting to a billing system, provisioning a Home Area Network (HAN) device, supporting prepay, and using metering information for asset management and engineering analysis.

STANDARDS/ REQUIREMENTS DOCUMENTS	SUBJECT	MDM IMPACT
IEC 61968/61970	Application-Level Energy Management System Interfaces	High
AMI-SEC System Security	AMI & SG End-to-End Security	High
NISTIR 7628	Guidelines for Cyber Security	High
SAP Meter Date Unification System	Defines Interfaces with SAP Solutions	High
NERC CIP 002-009	Cyber Security for Bulk Power Systems	High
Open Automated Demand Responses	Price Responsive & Direct Load Control	High
OpenHAN	HAN Device Communication, Measurement and Control	High
ZigBee® Smart Energy Profile	Interoperabiiity Standard for Products that Deliver Energy Usage Information	High
IEC 61850	Substation Automation	Medium
MultiSpeak	Defines Interfaces among Software Applications	Medium
ANSI C12.19/MC 1219	End Device/Meter Data Tables	Low
ANSI C12.22	Data Communication Networks for Metering	Low

Figure 1

Standards require commitment and cooperation

"Becoming IEC 61968-compliant requires substantial internal investments and a commitment to close collaboration with the IEC standards body," said Salazar.

"However, it pays significant dividends in the industry's ability to offer data management products accepted by a global market."

Of course, building and supporting standards-compliant systems takes ongoing commitment. Every facet of consuming and brokering data, from the smart metering systems to the utility back office systems using standards, must be reviewed and filtered through real-world experience before it can be included in production software.

When gaps exist between the standard and real-world requirements, solution architects must create extensions and/or necessary adjustments to the standards, and work to gain formal acceptance of the modifications to future versions. Closing the loop with the standards bodies is critical not only for effective interoperability, but also to the longevity and usefulness of the standard.

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Standards-based development is a powerful tool for removing risk from implementations and providing consistent end-to-end results from integrated systems within the utility smart grid environment.

Interoperability testing validates standards in a real-world environment. Tested use cases include operations such as:

- ***Sending and receiving end-device event messages***
- ***Requesting, receiving and sending meter-reading messages***
- ***Participating in meter control message exchanges to accomplish functions such as remote connect, remote disconnect and demand reset***

Standards-based development is a powerful tool for removing risk from implementations and providing consistent end-to-end results from integrated systems within the utility smart grid environment. For example, at Oncor, a large distribution utility in Texas, Landis+Gyr's Gridstream® RF and MDMS systems integrate with the utility's outage management system using the IEC-CIM 61968 standard. The combined solution enables Oncor to remotely complete 4 million service orders and proactively fix 20 percent of outages before customers call to report the issue.

"Designing data management solutions to be the most interoperable they can be protects current and future utility investment and expands the possibilities for how those solutions can be used in the years ahead," Salazar said. "That's why the time and resources invested in the process pays off for everyone." ■

FAST FACTS:

Standards for Data Integration

1. The International Electrotechnical Commission (IEC) members represent 81 countries around the world. Though members represent different national interests, they share a common interest in the vast array of interoperable electrotechnical devices.

2. The IEC has a long history with the utility industry. The Common Information Model (CIM), maintained by the IEC and underlies the IEC 61968 series of standards, has been widely adopted in the utility industry.

3. MultiSpeak began in 2000, between the National Retail Electric Cooperative Association (NRECA) and a small group of vendors. Today, it is used by more than 600 cooperatives, investor-owned utilities, municipals and public power districts in at least 15 different countries.

4. Landis+Gyr developed software interfaces based upon the IEC and MultiSpeak standards — years before the National Institute of Standards and Technology (NIST) identified these standards as foundational to the smart gird market in 2010.

Knowledge IS POWER:

Debunking Smart Meter Myths

We recently sat down with Patty Durand, Executive Director of the Smart Grid Consumer Collaborative (SGCC) — a nonprofit organization dedicated to advancing the adoption of smart grid through consumer research, advancement of best practices, and education and outreach. We asked her for recommendations about what utilities can do to constructively address anti-smart meter activities.

FR: What are some of the issues behind opposition to smart meters?

PD: At the SGCC, we're finding that health and privacy concerns are the major issues raised by groups opposed to smart meters. Some consumers are concerned that RF, or radio frequency, emissions from smart meters can cause illness, while others are concerned that the government will use the increased amount of data available from smart meters to learn about what they are doing in their homes.

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FR: To what extent have anti-smart meter campaigns swayed consumer opinion?

PD: Anti-smart meter groups have used various media outlets, news articles — even a documentary entitled, "Take Back Your Power" — to attempt to sway consumer opinion. However, according to our research, these efforts have not been successful. In fact, in a recent survey of more than 1,000 U.S. residential consumers, we found that overall awareness of the terms "smart grid" and "smart meters" continues to be quite low. This research, which will be released in November, shows that about 75% of U.S. citizens have never heard these terms or, if they have, have no idea what they mean. Of the remaining 25%, most have positive attitudes about the concepts.

FR: How should utilities respond to consumer misconceptions?

PD: Utilities should carefully select community ambassadors or skilled communicators and encourage them to meet personally with individuals who have voiced concerns. The worst thing a utility can do is to not address or respond to concerns or just send a form letter.

FR: What educational resources should utilities be aware of?

PD: The SGCC library of consumer education materials includes communications and outreach programs and case studies that demonstrate successful strategies used by five U.S. utilities. Our new consumer-facing website, www.WhatIsSmartGrid.org, provides a user-friendly introduction to smart grid topics.

FR: What are the top three facts that SGCC wants energy consumers to know about smart meters?

PD: First, RF emissions from smart meters are well below the limits set by the Federal Communications Commission and 10 times below levels produced by cell phones, garage door openers and TV remotes.

Second, cybersecurity is important to utilities, and there has never been a breach of a consumer's energy data.

Third, smart grid technology enables our nation to improve its aging electrical infrastructure. We will have fewer outages, increase use of renewable energy resources and empower consumers with information. ■

MTEMC

Tennessee Cooperative Selects GRIDSTREAM® For Smart Grid Project

The sixth-largest cooperative in the country selected Landis+Gyr's Gridstream solution for an advanced metering and load management project.

Middle Tennessee Electric Membership Cooperative (MTEMC) is deploying the Gridstream RF network, along with E-350 FOCUS® AX-SD meters, to enable a variety of advanced metering and load management applications, including dynamic load control and voltage management.

"Our goal with this project is to improve efficiency across the utility and reduce peak power costs in a way that benefits our members and improves our customer service," said Tom Suggs, Vice President of Engineering at MTEMC.

Gridstream works with advanced load management tools that include consumer engagement through variable pricing programs, virtual peaking plant software to monitor and confirm load shedding, and dynamic voltage management for peak voltage reduction and power quality monitoring.

MTEMC serves approximately 190,000 members in Williamson, Rutherford, Wilson and Cannon counties in central Tennessee. ■

CPS Energy to DEPLOY 700,000 Advanced Meters

CPS Energy will deploy Landis+Gyr's advanced residential electric meters for the utility's grid modernization effort, as Landis+Gyr continues to support the utility's New Energy Economy initiative to boost San Antonio's clean technology sector.

Landis+Gyr will provide 700,000 E-350 FOCUS® advanced meters with shipments beginning early in 2014. The meter upgrade project is anticipated to take four years. As part of the agreement, Landis+Gyr will partner with CPS Energy by supporting economic development, including job creation and support for an innovation center in San Antonio and local education scholarships.

> "As a partner on a number of initiatives, including a large scale demand response project, Landis+Gyr is helping CPS Energy create a more reliable grid and decrease load at times of peak demand," said Doyle Beneby, President and CEO of CPS Energy.

"By bringing jobs and supporting education, Landis+Gyr is also growing economic development in and around San Antonio."

In addition to metering technology, Landis+Gyr is operating a direct load control program at CPS Energy. The utility is using Virtual Peak Plant™ software and load control devices from Landis+Gyr to verify and measure energy savings from conservation events. The program has the potential to provide a verifiable reduction of 250 megawatts of peak demand.

CPS Energy is the nation's largest municipally owned natural gas and electric company, providing service to approximately 741,000 electric and 331,000 natural gas customers in the Greater San Antonio area. The company offers the lowest rates among the top 20 largest U.S. cities, while ranking number one in wind-energy capacity among municipally owned systems and number one in Texas for solar generation. ■

Events: Visit Landis+Gyr at these upcoming industry events:

DistribuTECH 2014
San Antonio, TX
January 28–30

Landis+Gyr
Booth #2449

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manage energy better

befutureready.com

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